Failure to Thrive

An Analysis of 83 Cases

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■ *The case histories of 83 children admitted to the hospital with a diagnosis only of failure to thrive were examined. In twenty-six cases there was evidence of maternal deprivation as a factor. Forty patients were found to have significant organic diseases as a possible or probable cause or contributing influence.*

Twenty-six were found to have some degree of mental retardation, either documented or suspected, but in nearly all of them there were associated factors presumably responsible, at least in part, for failure to thrive.

Several children had birth weight less than 2,500 grams, but no child was thought to grow poorly because of prematurity alone. Congenital anomalies such as cleft palate and other problems leading to feeding difficulties were not unusual.

In any case of persistent failure of an infant to gain adequately in weight and length, in which the cause is not evident, the child should be admitted to a hospital to determine response in a new environment. Also an adequate social history should be sought and siblings more closely evaluated; and careful study should be made of the renal, gastrointestinal, cardiac, pulmonary and central nervous systems, even if there are no symptoms or signs referable to these systems.

FAILURE TO THRIVE is defined here as lack of adequate growth in height and weight of a young infant or child for reasons that are not immediately apparent to the examining physician.

Growth failure is often associated with a well defined disease, such as cystic fibrosis of the pancreas, congenital renal disease, congenital disease of the heart, dystrophy of the osseous system and disorders of the endocrine system. In these disorders the nature of the associated disease is clear, although the cause of the growth deficiency and the mechanisms responsible for the growth retardation are not always known. In such cases the underlying disorder, such as congenital disease of

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the heart, is considered primary and the growth failure is considered to be an associated phenomenon. Patients falling into these categories may experience improvement in the rate of growth if the disease is successfully treated.

The purpose of this communication is to present a study of a group of infants and children with growth failure which was not associated with an obvious disease and the cause of which was not evident to the examining physician. The progress of these patients was followed during the period they were in hospital, and subsequently for varying periods, to determine what diagnosis, if any, was made during the stay in hospital or after a long period of follow-up. As a result of this study of some 83 cases, certain general conclusions have been drawn which may serve as guides to physicians confronted with cases of growth failure of unknown cause in infancy.

In order to select cases for the study, it was decided to include only those patients who were admitted to the hospital with the diagnosis of failure to thrive of unknown cause after thorough examination by a pediatrician. The admission procedures of this hospital require that the infant be seen by a pediatrician at least once before admission to the hospital. Most of the children were seen by several physicians before admission. The validity of this method of selection of patients is borne out by the fact that virtually none of the infants admitted to the study turned out to have a disease falling into one of the categories mentioned above as frequently associated with growth retardation. The screening procedures to which such infants were subjected before admission were sufficient in the vast majority of cases to exclude the diseases commonly associated with failure to thrive. The method of selection of cases, therefore, provided patient material which was representative of the problem as a whole.[1,13]

Materials and Methods

The case records of all children who were admitted to Children's Hospital of Los Angeles over a period of two and a half years with the "diagnosis" of failure to thrive as the reason for admission were selected for review. All patients had been seen by a physician before admission. The subsequent course of these children was examined to determine what, if any, causative factors were found for retardation of growth. Children admitted with the primary diagnosis of organic disease of the heart, lungs, pancreas or other organs and with a secondary diagnosis of growth failure were not included in the study. In order to determine the growth pattern of the children after discharge from the hospital, further information was obtained by (1) asking the patients to return for additional history and examination, (2) sending to the private physician a letter asking for his evaluation of the physical and mental development and for other pertinent facts in the medical history of the patient, or (3) correspondence or telephone conversations with parents or health agencies, requesting physical measurements of the children and other pertinent medical facts. The patients were finally categorized into five groups, although there was considerable overlap. The groups were as follows:

1. *Organic Disease Group.* This group was subdivided into acute and chronic illness categories and an attempt was made to ascertain if the organic illness was the cause of the failure to thrive. Children with mental retardation with or without evidence of other diseases were arbitrarily included in this group.

2. *Maternal Deprivation Group.*[9,10] This term is used in preference to *environmental deprivation,* although the mother may not have been the only person whose emotional influence was denied the child. These children grew inadequately in their usual environment but experienced more rapid growth after admission to the hospital or during periods of close supervision after the hospitalization. None of them had evidence of chronic organic disease, and improvement in growth rate was out of proportion to the results expected from medical therapy. It was frequently impossible to determine with certainty what environmental factor was lacking, but often there was overt evidence of improper feeding, malnutrition or parental neglect.

3. *Idiopathic Group.* No satisfactory reason for growth retardation was discovered in these children, despite careful study during hospitalization.

4. *Unclassified Group.* Some of the children with growth retardation could not be put into any of the other categories because the period of observation was very short or incomplete.

5. *Growth Retardation with Low Birth Weight Group.* Any child with a birth weight of less than 2,500 grams was included in this group, in addition to being classified in one of the above groups. This additional category was established to assess the role of prematurity or intrauterine growth

TABLE 1.—*General Information on 83 Patients with "Failure to Thrive"*

Group	No.	Male	Female	Median Age (mo.)	Number Referred by Physician	Deceased	Follow-up: Over 6 mo.	Follow-up: 3-6 mo.	Follow-up: Under 3 mo.	Median Length Follow-up (months)
Organic disease	40	23	17	4	31	5	34	2	4	22
Maternal Deprivation	26	15	11	5	8	1	18	2	6	18
Idiopathic	10	7	3	5	7	0	8	2	0	21
Unclassified	7	4	3	3.75	3	0	0	0	7	0.5
TOTAL	83	49	34	4	49	6	60	6	17	18

Infants with low birth weight are included in these four groups.

retardation as a primary or contributory cause of failure to thrive.

Results

The case histories of 83 children were reviewed. There were 49 males and 34 females, first seen at a median age of four months. Physicians in private practice referred 49 of the patients, and 34 came from the Out-Patient Department at Children's Hospital. Sixty were examined over periods of six months or longer, and the median follow-up period was 18 months (Table 1). Six children died while in hospital or during the follow-up period. Of these, five were known previously to have severe organic disease, and the sixth, who had no known disease, but who was included in the maternal deprivation group, was found dead in his crib at home. No information as to the cause of death could be obtained.

Twenty-seven of the 83 children had a significant degree of mental retardation (Table 2). The majority were evaluated by a standard intelligence testing. In some the retardation was so extreme that objective testing was considered unnecessary. Two had mental retardation as the only obvious factor related to their failure to thrive. Fourteen had associated organic defects and five were assigned to the maternal deprivation group. Six of the children were thought to have possible mental retardation but, for various reasons, adequate evaluation could not be carried out.

Organic Disease Group

Children exhibiting failure to thrive who had organic disease were generally very young when first seen. Sixteen of the 40 infants and children were less than three months of age when they were first admitted to the hospital. Except for a nine-year-old girl with celiac disease, the age range of the subjects when first seen was one day to ten months, and the median was four months. Many had an acute illness which in general did not retard their growth after treatment. The question whether organic disease was the probable or possible cause of growth failure has been difficult to resolve and an arbitrary differentiation had to be made, taking into account the nature and length of the illness, the age and the subsequent growth pattern. There were 23 males and 17 females in this group.

Twenty-nine of the children were kept under observation for a period of one year or more. Where the period was less than one year, the change in growth pattern generally paralleled the severity of the underlying disease. The types of illness in children falling into this category are listed in Table 3. In five cases the disease was considered as a possible cause of the failure to thrive, and in the remainder the disease was considered to be the probable cause. Electroencephalograms were reported as being within normal limits in two patients with mental retardation and abnormal in seven cases. Electroencephalographic tracings taken on three other children without mental retardation were reported as being abnormal in one who had a history of minor motor seizures, and within normal limits in the other two. Unless there was reasonably successful treatment of the organic

TABLE 2.—*Distribution of Patients with Mental Retardation among the Various Groups*

Mental Retardation	D.Q.	Organic Disease	Maternal Deprivation	Idiopathic	Short Follow-up	Total
Severe	50	10	1	..	..	11
Moderate	50-70	3	2	..	1	6
Mild	70-80	1	2	1	..	4
Possible	..	1	2	2	1	6

D.Q.—developmental quotient.

TABLE 3.—*Organic Diseases Found in Patients with Failure to Thrive*

		Number
I.	*Diseases of the Central Nervous System* (all with mental retardation)	
	Mental retardation, no other findings	2
	Mental retardation with cerebral palsy	1
	Mental retardation with cerebral palsy and microcephaly	1
	Mental retardation with cerebral palsy and a skull fracture at birth	1
	Maternal rubella syndrome with microcephaly and prematurity	1
	Down's syndrome with congenital heart disease	1
	Hydrocephalus, arrested	1
	Partial cleft palate	1
	Neurogenic dysphagia	1
II.	*Gastro-Intestinal System*	
	Chronic enterocolitis, fatty liver and pancreatic fibrosis	1
	Pyloric stenosis	1
	Glossoptosis with micrognathia	1
	Rumination	2
	Rumination with cleft palate	1
	Ischiorectal abscess	1
	Cardio-esophageal chalasia	1
	Cleft palate with imperforate anus and perineal fistula	1
	Infectious hepatitis	1
	Celiac syndrome	1
III.	*Respiratory System*	
	Chronic pneumonia (pneumocystis carinii?)	1
	Interstitial pneumonia	1
	Mucoviscidosis and asthma	1
	Mastoiditis and otitis media	1
	Chronic tonsillo-adenoiditis	1
	Peribronchial pneumonia	1
	Chronic sinusitis with intolerance to milk and wheat	1
	Chronic diarrhea with mastoiditis and otitis	1
	Chronic maxillary sinusitis	1
IV.	*Urinary Tract*	
	Pyelonephritis with chronic cystitis	1
	Pyelonephritis with pneumonia	1
	Pyelonephritis with ureteral hypotonia	1
	Pyelonephritis, E. coli diarrhea and ureteral stricture	1
V.	*Cardiovascular System*	
	Endocardial fibroelastosis	1
	Atrio-ventricular cushion defect (see also 2 cases of disease of the central nervous system)	1
VI.	*Miscellaneous*	
	Idiopathic hypercalcemia with mental retardation	1
	Vibrio bacteremia	1
	Icthiosiforme erythroderma and prematurity	1
	Hypogammaglobulinemia and bladder neck obstruction	1
		40

disease, no remarkable gain in weight was noted during the period in hospital. Two of the children who had significant organic disease, but who were probably given inadequate care in the home (patients with celiac disease and with pyelonephritis and chronic cystitis), gained significantly during each stay in the hospital.

Skeletal maturation was measured in 12 instances and was considered within normal limits in eight. Two children with severe mental retardation — one of whom had "chronic tonsilloadenoiditis," and the other cleft palate and ectopic anus — showed evidence of significant retardation of skeletal age.

Maternal Deprivation Group

Twenty-six of the 83 children were considered to qualify for the diagnosis of maternal deprivation. Many of these infants and children gained weight rapidly while under observation in the hospital or rehabilitation center. In others a rapid weight gain was observed when the infant or child was transferred to an environment different from that in which he existed during his period of failure to thrive. Significant weight gain in these circumstances was considered to be at least 1.5 ounces per day during the initial period of observation in the infants under six months of age and at least 1 pound a month in older infants during the period of observation.

The group consisted of 15 boys and 11 girls. In 18 of the children in this group, observations extended for a period greater than six months. As was previously mentioned, one child who was followed for a short time (two months) was subsequently found dead in his crib. He had gained 52 ounces during two periods in hospital which comprised a total of 26 days. Another child once had been admitted to hospital with a diagnosis of traumatic cerebral injury and subarachnoid hemorrhage before his admission for the complaint of failure to thrive. In many cases the medical historian recorded that the mothers beat the children. Two mothers abandoned their families, two mothers were ill with seizures (probably psychomotor), one mother was admitted to an institution for schizophrenia and another killed herself while her child was in the hospital. One child had otitis media and severe pyoderma on admission. There was good evidence, however, for maternal deprivation in this case, and a decided increase in weight occurred within a short period after admission.

Other points worthy of comment are as follows: There were two sets of brothers in this group. Twenty of the 26 patients were less than one year old and all but two were less than two years of age. The growth patterns in this group were variable. Although there was a significant gain in weight when the environmental circumstances were altered, in a two-year period of observation only one child reached a weight above the sixteenth percentile on the Iowa growth chart and a height within one standard deviation of the mean. After an initial spurt six infants and children gained steadily in height and weight, but both these dimensions remained abnormally small. Six children approached the sixteenth percentile in weight, but their height remained more than one standard deviation below the mean. Six of the children were under observation for too short a time to determine the nature of their growth pattern, although they did have an initial gain and did fit the criteria mentioned above. Two children, one with a severe emotional problem, gained very little, and the lines on the growth chart representing their rates of growth gradually fell away from the lines representing the sixteenth percentile. In four cases the height was not recorded often enough to establish a pattern. Skeletal age was assessed in nine children in this group, and in all of them osseous maturation was significantly retarded. It is interesting that only eight of this group of 26 were referred by physicians in private practice (Table 1).

Idiopathic Group

Ten children were included in this group. Four weighed less than 2,500 grams at birth and will be discussed below in the low birth weight group.

The period of follow-up ranged from three months to nearly five years. Seven were observed for a year or more. The shorter follow-ups were seven, five and three months. In this group, again, one child showed evidence of renal infection and subnormal function, one child had otitis media and diarrhea at the age of three weeks, and one had possible pyelonephritis when seen at the age of one month, although the diagnosis was not documented. One child vomited frequently and had persistent low fever, hypotonia and reduction or absence of deep tendon reflexes. The father was said to have had similar symptoms in the neonatal period, but recovered adequately. The child's physician indicated that the symptoms had disappeared after the second birthday and that he was in good health. A fifth child in this group had no symptoms and an excellent appetite on admission, but diarrhea developed after he entered the hospital.

The child with duplication of the renal pelvis subsequently gained weight adequately and reached the normal range in height and weight. The child with fever and hypotonia and the child with otitis media continued to gain regularly but had not reached normal height or weight. Follow-up examinations were not permitted in the case of the child with suspected kidney infection; but the father stated that at the age of five and a half months the child's weight was 17 pounds. The child in whom diarrhea developed shortly after admission to the hospital was observed for a period of three months only but seemed to be gaining adequately in height and weight. The diagnosis at the time of discharge was that of poor caloric intake, and this child may well have been affected by maternal deprivation. One child, who had a strong family history of allergic disease, was admitted with chronic cough, rhinorrhea and conjunctivitis and had several bouts of upper respiratory infections with otitis media during follow-up. He gained well, subsequently, into the normal range in both height and weight. In two patients with normal birth weight, bone age was measured and found to be within normal limits None of these children was considered to have significant mental retardation.

Unclassified Group

This group comprises seven children who were followed for relatively short periods and the cause of failure to thrive was not apparent. The ages when first seen ranged from eight days to one year. The follow-up period ranged from eight to fifty days. Four of the seven had vomiting, one had diarrhea, one fever, and one "persistent weakness." One had moderate mental retardation, unsuspected fractures on admission and a normal electroencephalogram. A sibling had similar problems. This may be an example of the "battered child syndrome." One child had mild arrested hydrocephalus, with possible mild motor retardation, at one year of age. One child was said to be premature even though the birth weight was 5 pounds, 14 ounces, and had a skull fracture at birth. Another child with a birth weight of 5 pounds following an apparently normal period of gestation, was admitted with complaints of vom-

TABLE 4.—*Information on 11 Patients with Low Birth Weight*

Patient	*Birth Weight* Lbs.	Oz.	*Gestation*	*Other Diseases Known or Suspected*
C.C.	3	12	"Premature"	Icthiosiforme erythroderma
D.G.	4	14	37 weeks	Interstitial pneumonia with atelectasis
J.C.	4	13	Not premature	Mental retardation, partial cleft palate
B.B.	5	0	"Overdue"	Mental retardation, spasticity
S.P.	3	3	"Premature"	Microcephaly with rubella syndrome
T.D.	4	14	35 weeks	Maternal deprivation
S.E.	5	0	Not premature	Suspected maternal deprivation
M.C.	5	1.5	Not premature	Poor speech development and myopia
E.R.	4	14	Term twin	Poor suck, mild retardation Twin sibling "twice as big"
M.B.	5	2	37 weeks	"Improper feeding"
P.K.	5	7	38 weeks	Duplication right renal collecting system Congenital hip dysplasia

iting and poor growth. Vomiting ceased on admission. It was found that the mother required careful instructions as to how to feed the child and the diagnosis on discharge was that of improper feeding. Two children had pneumonia, and one of the two also had hypotonic cerebral palsy and possibly mental retardation. None of the children in this group gained significantly in weight during the time in hospital. Over a more extended period of observation all the children were found to be gaining at subnormal rates. The child with moderate mental retardation and the child with cerebral palsy both had abnormal electroencephalograms. Bone age was measured in two and found to be within normal limits.

Low Birth Weight

Eleven children among the 78 in whom the birth weight was recorded weighed less than 2,500 grams at birth. For one of them the follow-up period was only 21 days. Five of the remaining ten had organic disease, one had evidence of maternal deprivation and four were also included in the idiopathic group. In all, six were said to have been born prematurely or after less than 40 weeks of gestation. There were four children whose birth weight was subnormal in whom no cause for growth retardation could be found. They were first seen at the ages of three, four, five and twelve months and were observed over periods of seven months to three years. The birth weights were between 4 pounds 4 ounces and 5 pounds 7 ounces. In one, duplication of the renal collecting system was noted on one side, but there was no evidence of infection or inadequate renal function. The other three had no significant disease. Three of the four had slight degrees of mental retardation. One child had considerable feeding difficulties. The twin of this child weighed 2 pounds more than his brother at birth and at the time of observation was close to the 84th percentile in weight, whereas the patient continued to have a subnormal growth rate. One child with no symptoms did reasonably well until the age of six months and then showed no significant weight gain between ages of six and twelve months. Pyelonephritis was said to have occurred at the age of nine months and speech development was poor. Two of the three children in this group whose bone age was measured, had retardation of osseous maturation.

Discussion

The grouping of the children into the categories designated above is arbitrary. It is of considerable interest that in one-third of the children the failure to grow adequately was apparently because of an inadequate environment at home. A decision as to whether maternal deprivation is the cause frequently cannot be made even after the most careful history from the parents. Accurate histories are often not obtainable in such cases because of unwillingness of the parents to disclose the truth or because of their ignorance of the existence of the problem. The cause of failure to grow in children with maternal deprivation is complex.[9,10] It is not clear whether growth failure results from insufficient intake of food, from decreased intestinal absorption or from more complex factors associated with disturbance of the social and emotional environment.[2,5,6,11,12] Provided the period of maternal deprivation is not prolonged, recovery can be expected with reasonable certainty. It is important for physicians to recognize this syndrome when it occurs so that adequate steps can be taken to prevent a return of the infant to the unfavorable environment.

This study focuses considerable emphasis on the association between mental retardation and poor

growth. There seem to be few children with mental retardation as the only cause of failure to grow; however, a considerable number of patients were mentally retarded. A child with mental retardation is also likely to be a candidate for caloric undernutrition and "maternal deprivation." Lack of response of the infant to his mother may result in inadequate maternal care. The exact roles of caloric undernutrition and organic brain damage in failure to grow are not understood.[7,8]

The frequent occurrence of organic disease in these children emphasizes the necessity for complete and careful physical examination of the child with failure to thrive. Persistent failure to grow requires that the child be admitted to a hospital for a complete and thorough investigation. At this time a careful search should be made for disease of any major organ such as stomach and intestines, kidneys, heart, lungs, pancreas, brain. Objective measurements of psychomotor development should be made. Such a thorough search is justified by the fact that an important disorder may not be evident except on extraordinary investigation.

It is noteworthy that the endocrine system is very rarely implicated in cases of failure to thrive. It may be that additional testing of some of the children in the idiopathic or unclassified groups will subsequently show that they have somatotropin deficiency, but it is unlikely that such cases will be more than a small fraction of the total number. Children with low birth weight falling into the category of primordial dwarfism or those born prematurely with feeding difficulties seem to make up an important segment of the children admitted with the diagnosis of failure to thrive.[3,7] Chronic infections and allergic involvement of the respiratory system are occasionally important.

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